Cantor's history now comprises 2218 pages. The final installment, reaching to the year 1759, and which is yet to appear, will certainly not increase its bulk to much over 2600 pages, leaving the vast material from the date of Lagrange's first memoirs on to be elaborated by another hand. The history will thus hardly exceed in size some of its predecessors, but it will contain proportionately more material, from its being almost exclusively devoted to the solider scientific aspects of its subject and not so much to biographical and personal details, which served so greatly to swell the work of Montucla. In fine, it is far and away the concisest, yet most comprehensive and authoritative treatment of the subject that we have. As such, it is the indispensable adjunct of every mathematical worker and absolutely necessary in every mathematical library. T. J. McC.

PHYSIKALISCH-CHEMISCHE PROPAEDEUTIK. Unter besonderer Berücksichtigung der medicinischen Wissenschaften und mit historischen und biographischen Angaben. Von *Professor Dr. Med. et Phil. H. Griesbach.* Erste Hälfte. 272 Pages. Price, M. 6. Zweite Hälfte, I. Lieferung, 320 Pages. Price, M. 7. Leipsic: Wilhelm Engelmann. 1895 and 1896.

The present work is in the nature of an encyclopædic introduction to medicine, and deals with the specific chemical and physical facts, as well as methods, which enter into the foundations and structure of that science. The work is published in two parts, comprising three installments of some 300 pages each, and covers an unusually vast field. Its author is a man of scientific attainments and of wide and profound bibliographical knowledge. He has materially added to the attractiveness of the work by interweaving with his expositions a great mass of biographical and historical data. Each subject treated acquires thus a developmental form, well adapted to strengthening the memory of the student for the different subjects. Altogether, we have in the book an abridged history of science, and even of philosophy, the main subjects of which are also incidentally touched upon. Since the work presumes no special scientific or mathematical knowledge, it may be used with profit by every student, no matter what his profession or sphere of activity, the material it offers being such as should be known by every educated member of society. Further, on all the subjects coming within the designation of the "propædeutics of physics and chemistry" it constitutes a valuable reference book of the facts, and more especially of the literature, as also an etymological dictionary of scientific terms. That many dubious philosophical considerations should have slipped into a work which covers so vast a field and sounds the depths of so many sciences is natural and intelligible. This we shall see in the following review of the contents:

We have in Chapter I. a discussion of the character of science and logic; in Chapter II. a discussion of the character, method, and aim of physical science; Chapter III. treats of the origin of physical and chemical science and of scientific observation; in Chapter IV. space and time are treated. Here the author takes the

position that the questions why space is three-dimensional and time is one-dimensional, are problems that lie totally without the bounds of human comprehension. Even his own views on the subject are not confidently pronounced, for who, he says, would dare to assert he had found the solution of questions thus hovering at the boundary-line of human thought.

In Chapter V. we have a brief note on causality. In Chapters VI., VII., and VIII. we have a good presentation of the principles of mensuration and of metrical systems, of the graphic representation of natural phenomena, and of the measurement of space and time, all of which is accompanied by appropriate descriptions and illustrations of instruments and methods. One of the most important chapters is that on matter, energy, work, and force, into which considerable metaphysical speculation has been introduced. 'Apart from mind,' the author asserts, 'we 'find but one thing possessing real and absolute existence in the world, and this 'one thing we call substance. Substance comprises matter and energy, and when 'we speak of matter and energy we must be understood as making the tacit as-'sumption that both are simply integral parts of one and the same substance.'

We catch at once the author's metaphysical point of view. He says further: 'That which science calls matter is identical with but one of the component parts 'of the substance present in the physical cosmos. Further, it is practically impos-'sible to conceive of dynamic effects as not proceeding from some vehicle. Conse-'quently energy, as the component part of a substance, must itself be substantial, 'has the same right to be considered such as matter. Energy is not an independent 'substance, but, combined with and supplementing matter, it forms, together with 'the latter, the ultimate uncreatable and indestructible substance that constitutes 'the physical All.'

Heat, light, and electricity are sub-species of energy, and the author finds no philosophical impediment in saying that energy *possesses* a capacity to perform work. The development of the theory of energy has been made the basis of this work, and the philosophical interpretation of its significance is a point upon which the author apparently lays great stress. We have only to add that so deeply has the power of the chemical and molecular theories of physics impressed his mind that he actually proposes a molecular hypothesis of energy. Even Professor Ostwald, who has approached this conception very nearly, writes in a private letter to Dr. Griesbach that he sees at present no occasion for a molecular hypothesis of energy. It is certainly difficult to see what satisfaction the solution of a problem can give which simply refers its difficulties farther and farther back and associates them with less palpable and more tenuous particles. If such theories can satisfy the mind in the long run, it will not be long before we shall be conceiving of motion as a substance.

Chapter XI. treats of the measurement of velocity; Chapters XII. and XIII. of centrifugal forces and their practical applications, of friction and obstacles to motion; Chapters XIV., XV., XVI., and XVII. treat of the divisibility and constitu-

tion of ponderable matter, of the important question of the constitution of the ether, of the history of atomistic theories and of organic and inorganic matter. In the following chapters, so far as the second installment, we have discussions of the porosity of matter, with demonstrations and suggestions of its significance in applied science. Atmospheric pressure is treated, barometers, and manometers fully described, and finally, there is a long and important chapter on aggregate states of matter. The biological and physiological chapters in the first two installments contain a wealth of material, brought down to date. The pathogenic properties of organised matter are treated of here, the conditions of fermentation and of the production of disease by bacteria, with good studies of typical forms of micro-organisms. The bibliography is particularly full and valuable.

The third installment, which has not yet reached our hands, will deal mainly with the science of energetics, including heat, gravitation, radiant and chemical energy, discussing the sources of energy, its laws, the foundations of modern chemistry, and not omitting other branches of physics which are of importance in the propædeutical studies which the author has in view. *μκρκ.*

ESSAIS SUR LA PHILOSOPHIE DES SCIENCES. Analyse.—Mécanique. Par C. De Freycinet. Paris: Gauthier-Villars et fils. 1896. Pages, 336.

M. Freycinet seeks to answer such questions as, What is the exact nature of the notions of infinity and infinitesimal quantities whereon the higher analysis rests? Wherein does the "invention of Leibnitz" differ from the common algebra? What share of the contents of mechanical principles is to be assigned to reasoning and what to experience? What assures the conservation of force and energy? May we predict a gradual slackening of the causes that agitate matter? And so forth.

The notions of Analysis, M. Freycinet contends, are derived directly from the notions of space and time, which for him are necessary, infinite, continuous, and homogeneous. His speculations on this topic are essentially based upon the reflexions of Pascal who, he says, would certainly have invented the Differential Calculus had he not been early called away from science by his excessive religiosity. Infinity is immanent in nature and inherent in mind, escaping intimate comprehension, yet serving accurately our purposes,—a necessary attribute of the world of sense and intellect: and hence its power. The parallelism of mind and nature, in fact, runs all through M. Freycinet's book, and furnishes him with a satisfactory key to many metaphysical problems. So here, after an examination of the Calculus and of its applicability to Physics, he finds "that the Infinitesimal Analysis is alike admirably adapted to the phenomena of nature and to the conceptions of human reason,—apparently forming a bond of union between the intellect and the outer world, which is the highest commendation one can bestow upon it." And the same consideration is applied to the notions of Mechanics, where it is said that "the human mind and nature form integral parts of the same system, by virtue of which the one is richly equipped for the comprehension of the other;" and he illustrates his idea by the example of the Apollonian discovery of conic sections, centuries before their employment as a model of the planetary system. Generally Mr. Freycinet's reflexions upon the subject of limits and the infinitesimal method are lucid and unobjectionable, and from their simplicity may be re-